

# Preliminary Studies on the Rotatorian Fauna of Korea<sup>1</sup>

KOKICHI YAMAMOTO<sup>2</sup>

## INTRODUCTION

THOROUGH LIMNOLOGICAL SURVEYS in Korea have not been carried out up to the present time; only a few brief studies on the plankton, especially on the rotatorian fauna, have been made in several districts. There are papers relating to the Korean rotatorians published by five authors, namely, Kawamura (1917), Hada (1936), Ueno (1941), Sato (1939, 1941), and Yamamoto (1941). One of the reasons why such studies have been neglected is the paucity of lakes and ponds suitable for collections, except for a series of brackish-water lakes on the coast of the Japan Sea and reservoirs recently built for hydroelectric plants. The studies of the fresh-water fauna of Korea are quite incomplete when compared with those made on the fauna of Manchuria, which has been clarified by several researches under the direction of Professor T. Kawamura and summarized by Yamasaki (1940).

The author, accompanied by M. Ueno, made a trip for limnological work to the middle, eastern, and western districts of Korea from November 19 to 26, 1941. Since returning to the laboratory the author has engaged in a microscopical study of the rotatorians in the plankton obtained. At the same time, collections made by us in the preceding year in the northern part of Korea, as well as materials preserved in our laboratory, were examined. These latter consist of specimens which were collected by T. Kawamura during

June, 1936, and by A. Tanaka in Lake Puchon-ho in 1931.

Through the courtesy of T. Kamita of Keijo Normal School, some plankton samples collected by T. Sato in the City of Keijo (Seoul) and the neighborhood were placed at my disposal for study. The rotatorians found in all these collections are reported upon in the following pages. Previous records are included in the list.

As the specimens treated here have been collected not only in a limited season but also from comparatively confined localities, they are not sufficient basis for a full discussion of the rotatorian fauna of Korea. The survey was to include different seasons and additional various localities, but the program was of necessity changed by the outbreak of war. Difficulties of travel had increased day by day, and finally the war made continuation of our survey in this peninsula impossible. Therefore, this report is based on limited material.

I wish to express my thanks to Doctor Ueno for his kind advice during the journey and in the research room.

## LOCALITIES

The specimens examined were obtained from 16 bodies of water, which included all localities from which there are previous records. They are placed in four regions—northern, middle, eastern, and western—no collections having been made in the southern portion of the peninsula. The stations are shown on the sketch map in Figure 1. Table 1 shows some ecological data for the stations examined by Ueno and Yamamoto; such data

<sup>1</sup> Contribution No. 133 from the Otsu Hydrobiological Station of the University of Kyoto.

<sup>2</sup> Otsu Hydrobiological Station, University of Kyoto. Manuscript received March 23, 1949.

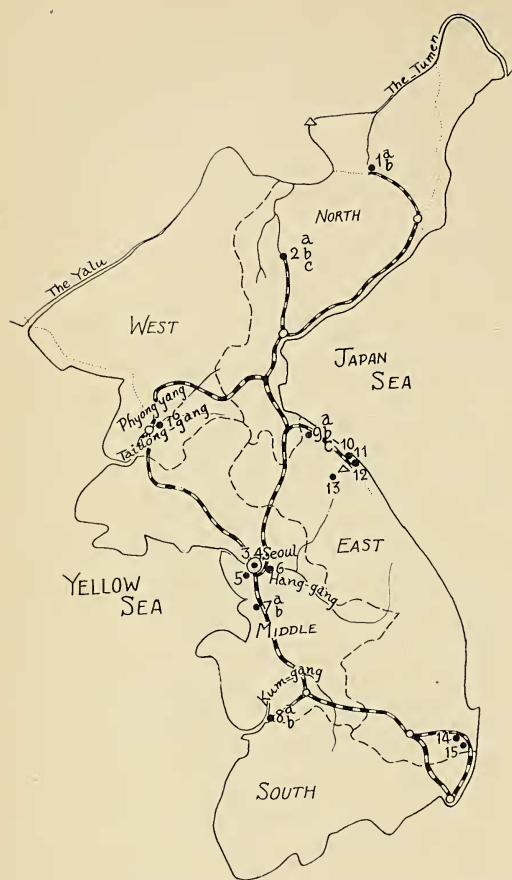


Fig. 1. Map of Korean Peninsula showing the five main regions and the collection localities (1-16). (Heavy broken line indicates railways.)

are unavailable for the earlier collections by Tanaka, Kawamura, and Sato.

1. Daitaku (cf. Ueno, 1941) (Tai-taik).

This is a bog lake situated in the moorland of the Paik-mo high plateau, Ham-Gyon Puk Do. Pelagic (station 1a) and littoral (1b) plankton were collected. Some microorganisms were also obtained among the mosses of the surrounding swamp.

2. Lake Fusenko (cf. Ueno, 1941) (Puchon-ho).

This is a gigantic reservoir for the hydroelectric plant which has dammed the river Puchon-gang, an upper tributary of the river Yalu. The collections by A. Tanaka (2b) from this lake were obtained during its early stages as a lake.

3. A small pond at Shochudan in Seoul.
4. A small pool at Shindocho in Seoul.
5. Eitoho, southwestern suburb of Seoul.
6. River Kan-ko (the Hang-gang).

The potamoplankton was collected on the river in cross section at Tokuson, southeastern suburb of Seoul.

7. Seiko or West Lake, south of Seoul.

One of the collections examined was made by T. Kawamura (7a) 5 years before our visit (7b). This lake was built artificially about 300 years ago at the foot of Mt. Reiki, imitating the site of Si-hu in Hangchow, China.

8. Kanggyong.

Station 8a is a pond with luxuriant growth of water weeds among rice fields. Its surface area is about 100 square meters.

Station 8b is an oxbow lake on the meandering lower reaches of the river Kum-gang.

9. Lake Kodoho (Kangdong-po).

This brackish lake of medium area is situated near the coast of the Japan Sea. The collections were done at three stations, one being the center of the lake (9a), the next (9b) near "Jichudai," an island situated south of the center, and the last (9c) in the southern basin.

10. A pond near the Sanjippo railway station.

On the east of the railway station there is a small pond with clear water in an area surrounded by granite rocks.

11. Lake Sanjippo (Sam-il-po).

This lake is also situated in the granite area and has very clear water. The collection was made by using a boat at the southern extremity of the lake.

12. Lake Kanko (Kam-ho).

This is a small pond which is situated among pine forests on the coast of the Japan Sea.

13. Inner Diamond Mountain (Kumgang san).

The plankton was collected by Kawamura from the small pond of the Choanji Temple.

14. Gan-o-chi.

This small pond of badly contaminated water is historically famous. It is said that this pond was built nearly 2,000 years ago in

TABLE 1  
ECOLOGICAL DATA AT VARIOUS COLLECTION STATIONS IN KOREA

STATION NUMBER	REGION	HOUR	DATE	AIR TEMP.	WATER TEMP.	pH	RpH	PER CENT CL
				°C.	°C.			
1(a,b)	N	14	15 VII 1940	21.0	19.5	6.3	6.1	.....
2a	N	10	11 VII 1940	.....	21.0	6.8	.....	.....
6	M	10	22 XI 1941	11.2	9.8	7.4	7.3	.....
7b	M	14	9 XI 1941	17.6	12.7	6.6	6.7	.....
8a	M	13	24 XI 1941	13.0	11.4	8.6	8.2	.....
8b	M	14	24 XI 1941	11.9	11.8	7.8	7.8	0.08
9a	E	14	14 XI 1941	15.8	12.0	7.7	7.3	.....
9b	E	.....	14 XI 1941	.....	.....	7.9	7.6	.....
9c	E	16	14 XI 1941	.....	12.4	8.6	8.6	0.97
10	E	9	12 XI 1941	9.8	9.2	6.3	6.3	.....
11	E	10	12 XI 1941	15.0	11.5	6.5	6.4	.....
12	E	15	12 XI 1941	15.5	15.8	7.0	7.2	.....
14	E	10	27 XI 1941	9.8	8.7	6.8	6.9	.....
15	E	9	26 XI 1941	5.9	9.2	6.9	7.0	.....
16	W	14	17 XI 1941	18.5	11.7	7.7	7.4	0.02

the garden of the Royal Palace in Keishu (Kyongju).

15. A pond west of the Bukkokuji railway station.

Two kinds of collections were made, one from near the surface (15a) and the other from the bottom (15b).

16. River Taidong-gang at Phongyang.

The potamoplankton was collected on the river near Hangetsu-to (Halfmoon Island) in 5 minutes' upstream sailing.

SPECIES FOUND IN PRESENT MATERIAL

As the result of research on the materials from the stations mentioned above, 73 species (including 8 varieties and 7 forms) belonging to 10 families and 26 genera have been identified. Besides these there were several species impossible to identify because of the strong contraction of the body. Seven species, which appeared in the previous records, could not be found in the present examination. Thus, at present 83 species are known to occur in Korea. Although this is not a large number of species, it compares well with the number recorded from Japan.

In the following list the distribution within Korea is indicated by region and station. The known distribution in other parts of the Far

East is also given. Species marked with an asterisk are not present in the material studied.

Order FLOSCULARIACEA  
Family CONOCHILIDAE

- 1. *Conochiloides dossuarius* (Hudson) (M-8b) Japan, Manchuria, Sumatra, Bali.
- 2. *Conochilus hippocrepis* (Schränk) (N-1a, 1b, 2b; M-4) Japan, China, Manchuria.
- 3. *Conochilus unicornis* Roussélet (M-7a, 7b [Hada, 1936]) Japan, China, Manchuria.

Order PLOIMA  
Family NOTOMMATIDAE

- 4. *Monommata grandis* Tessin (N-1b) Japan, Manchuria, Sumatra.
- 5. \**Notommata* sp. (N-1b).
- 6. *Scaridium eudactylosum* Gosse (E-15b) Japan, China, Manchuria.
- 7. *Diaschizza gibba* (Ehrenberg) (N-1b) Japan, China, Sumatra, Java.

Family SYNCHAETIDAE

- 8. *Synchaeta longipes* Gosse (M-7b).
- 9. *Synchaeta oblonga* Ehrenberg (N-2a; M-7b; E-9a, 9b, 9c, 15a) Japan.
- 10. *Synchaeta tremula* (O. F. Müller) (N-7b; E-9c) Japan, China, Java.
- \**Synchaeta* spp. (N-2c; E-12, 14).



11. \**Ploesoma hudsoni* Imhof (M- [Hada, 1936]) Japan.
12. *Poesomla triacanthum* Bergendal (N-1b) Japan.
13. *Ploesoma truncatum* (Levander) (N-2a, 2c; M-7b, 8b) Japan, Manchuria.
14. *Polyarthra euryptera* (Wierzejski) (M-7a, 7b, 8a, 8b; W-16) Japan, China, Manchuria.
15. *Polyarthra trigla* (Ehrenberg) (N-1a, 1b, 2a, 2c; M-3, 5, 7a, 7b [Hada, 1936], 8a; E-9a, 9b, 9c, 10, 11, 12, 14, 15) Japan, China, Manchuria, Java.
16. *Polyarthra trigla* var. *major* Burckhardt (M-7a, 7b) China.
17. *Polyarthra trigla* var. *remata* Skorikov (M-7a, 7b) China.

## Family TRICHOCERCIDAE

18. *Trichocerca capucina* Wierzejski et Zacharias (M-5, 7a, 7b [Hada, 1936]) Japan, China, Manchuria.
19. *Trichocerca cristata* Harring (E-9c) Japan, China, Manchuria.
20. *Trichocerca cylindrica* (Imhof) (M-7a, 7b; E-9c) Japan, Manchuria.
21. \**Trichocerca elongata* (Gosse) (M-[Hada, 1936; Kawamura, 1916]) Japan, China, Manchuria.
22. *Trichocerca longiseta* (Schränk) (N-1a; M-8a, 8b; E-12, 14) Japan, China, Manchuria.
23. *Trichocerca pusilla* Jennings (M-7b [Hada, 1936]) Japan, China, Manchuria.
24. *Trichocerca stylata* (Gosse) (M-7b) Japan, Manchuria.
25. *Diurella brachyura* (Gosse) (E-15b) Japan, China, Manchuria, Sumatra, Java.
26. *Diurella porcellus* (Gosse) (E-15b) Japan, China, Manchuria.
27. *Diurella stylata* Eyferth (M-5, 7b; E-14) Japan, China, Manchuria, Sumatra, Java.
28. *Diurella tigris* (O. F. Müller) (N-1b; M-[Hada, 1936]; E-15a, 16b) Japan, Manchuria.
29. *Diurella weberi* Jennings (E-15a) Sumatra, Java.

## Family ASPLANCHNIDAE

30. *Asplanchna priodonta* Gosse (N-2a, 2b, 2c; M-3, 5 [Sato, 1941], 7a, 7b [Hada, 1936], 8a, 8b; E- [Sato, 1941], 10, 13, 15a) Japan, China, Manchuria. Java.

## Family BRACHIONIDAE

31. \**Brachionus angularis* Gosse (E- [Sato, 1941]) Japan, China, Manchuria, Java.
32. *Brachionus angularis* var. *bicens* (Plate) (M-3, 8a, 8b) Japan.
33. *Brachionus budapestinensis* Daday (M-3) Japan, China, Manchuria, Formosa.
34. *Brachionus calyciflorus* Pallas (M-8a; E-14) Japan, China, Manchuria, Java.
35. *Brachionus calyciflorus* f. *amphiceros* Ehrenberg (M-3, 8a) Japan, China, Manchuria.
36. *Brachionus calyciflorus* f. *anuraeiformis* Brehm (M-3, 8a) Japan, China, Manchuria.
37. *Brachionus calyciflorus* var. *dorcas* Gosse (M-3, 8a) Japan, China, Manchuria.
38. *Brachionus calyciflorus* var. *dorcas* f. *spinosus* Wierzejski (M-3, 8a) Japan, China, Manchuria.
39. *Brachionus forficula* Wierzejski (M-5) Japan, China, Manchuria.
40. *Brachionus quadridentatus* Hermann (M-3; E- [Sato, 1941]) Japan, China, Manchuria, Java.
41. *Brachionus quadridentatus* var. *brevispinus* (Ehrenberg) (E-9c) Japan, China, Manchuria.
42. *Brachionus urceolaris* O. F. Müller (E- [Sato, 1941], 14) Japan, China, Manchuria.
43. \**Platylabus patulus* (O. F. Müller) (M-[Hada, 1936]) Japan, China, Manchuria, Java, Bali.
44. *Keratella cochlearis* (Gosse) (N-2a, 2b; M-3, 5, 6, 7a, 7b [Hada, 1936], 8a, 8b; E-10, 13, 14, 15a, 15b) Japan, China, Manchuria, Java.
45. *Keratella cochlearis* var. *macracantha* (Lauterborn) (N-1a, 1b) Japan.
46. *Keratella cochlearis* var. *tecta* (Gosse) (N-2a;



- M-5, 7a, 7b [Hada, 1936], 8a, 8b; E-9b, 12, 14) Japan, China, Manchuria.
47. *Keratella cochlearis* var. *tecta* f. *micracantha* (M-5, 7a, 7b).
48. *Keratella cruciformis* (Thompson) var. *eichwaldi* (Levander) (E-9a, 9b, 9c) Japan.
49. *Keratella quadrata* (O. F. Müller) (N-1b, 2a, 2c; W-16) Japan, China, Manchuria.
50. *Keratella serrulata* (Ehrenberg) (N-1b) Japan.
51. *Keratella valga* (Ehrenberg) f. *asymmetrica* Barrois et Daday (M-3, 8b; E- [Sato, 1941]) Japan, China, Manchuria.
52. *Keratella valga* (Ehrenberg) f. *monstrosa* Barrois et Daday (M-3, 5) Japan, China, Manchuria.
53. *Keratella valga* (Ehrenberg) f. *tropica* Apstein (E-9a, 9b, 9c, 12) Japan, China, Manchuria.
54. *Notholca acuminata* Ehrenberg (E-9a, 9c, 12) Japan, Manchuria.
55. *Notholca labis* Gosse (E-9b, 12) Japan.
- 56.\**Anuraeopsis* sp. (M- [Hada, 1936]).
67. *Monostyla pyriformis* Daday (E-11) Japan, Sumatra, Java.
68. *Lepadella acuminata* (Ehrenberg) (E-15b) Japan, Sumatra.
- 69.\**Lepadella borealis* Harring (M- [Hada, 1936]).
70. *Lepadella ovalis* (O. F. Müller) (N-1b; E-12) Japan, China, Manchuria, Sumatra.
71. *Colurella adriatica* (Ehrenberg) (M-8b; E-9a) Japan, China.
72. *Colurella lepta* (Gosse) (E-9b, 9c) Japan, China.
73. *Colurella obtusa* (Gosse) (E-9a, 9b, 9c) Japan, China, Sumatra.
74. *Mytilina trigona* (Gosse) (N-1b) Japan.
75. *Mytilina ventralis* (Ehrenberg) (N-1b) Japan, China, Manchuria.
- 76.\**Mytilina ventralis brevispina* (Ehrenberg) (M- [Hada, 1936]) Japan, China, Manchuria, Java.
77. *Trichotria tetractis* (Ehrenberg) (N-1b) Japan, China, Manchuria, Sumatra, Java.
78. *Trichotria truncata* (Whitelegge) (M- [Hada, 1936], 8a; E-14, 15b) Japan, Manchuria.

## Family EUCHLANIDAE

57. *Euchlanis alata* Voronkov (N-1b) Japan.
58. *Euchlanis dilatata* Ehrenberg (E-9a, 9b, 9c, 12, 14; W-16) Japan, China, Manchuria, Sumatra.
59. *Euchlanis triquetra* Ehrenberg (N-1b) Japan.
60. *Lecane brachydactyla* (Stenroos) (N-1b, 1c) Japan.
61. *Lecane ludwigii* (Eckstein) (E-15b) Japan, China, Manchuria, Sumatra, Java.
62. *Lecane luna* (O. F. Müller) (M- [Hada, 1936; Kawamura, 1917]; E-9b) Japan, China, Manchuria, Sumatra, Java.
63. *Monostyla arcuata* Bryce (M-8a) Japan, China, Manchuria, Sumatra.
64. *Monostyla crenata* Harring (N-1b) Japan, China, Manchuria, Java.
65. *Monostyla hamata* Stokes (N-1c) Japan, China, Manchuria, Sumatra, Java, Bali.
66. *Monostyla lunaris* (Ehrenberg) (N-1a, 1b; M- [Hada, 1936]; W-16) Japan, China, Manchuria, Sumatra, Java.

## Family FILINIIDAE

79. *Filinia longiseta* (Ehrenberg) (N-2a, 2b; M-3, 5, 8a, 8b; E-9c, 15a) Japan, China, Manchuria, Sumatra, Java.
- 80.\**Pedalia mira* (Hudson) (E- [Sato, 1941]) Japan, China, Manchuria, Sumatra.

## Family TESTUDINELLIDAE

81. *Testudinella bidentata* (Ternitz) (N-1a) Japan.
82. *Testudinella patina* (Hermann) (E-9a, 9b, 9c, 15b) Japan, China, Manchuria, Sumatra, Java.

## Order BDELLOIDA

## Family PHILODINIDAE

- 83.\**Rotaria* sp. (N-1c; E-9b, 10, 15b).

## NOTEWORTHY SPECIES

Brief descriptions of some unusual species which have been observed are given here.

***Euchlanis alata* Voronkov, 1912**

Pl. 2, Figs. 26, 26a, 26b, 27

1912 *Euchlanis alata* Voronkov, Mus. Zool. [St. Petersburg], Ann. 16: 210.

Dorsal plate: length, 335  $\mu$ ; width, 315  $\mu$ ; frontal width, 160  $\mu$  (winged form). Foot, 110  $\mu$ ; toe, 18  $\mu$ .

The body consists of two plates, dorsal and ventral, the dorsal one being much the larger, about twice as wide as the ventral. No keel is present on the back. In the winged form, both sides of the dorsal plate are expanded to at least two thirds the length. The posterior tip of the wing is pointed, turned slightly upward, making the greatest width. The central posterior part gradually becomes low and has no notch. At the anterior extremity a large V-shaped notch is present. The wingless form is elliptical.

The ventral plate is slightly convex, elongate elliptical, its posterior border parallel to that of the dorsal plate.

The foot is large, two-jointed, with one pair of toes.

A large central, anterior eye-spot is present.

Both the winged and the wingless forms were collected from the littoral region of Tai-taik (1b). They are 20 per cent larger than the form recorded by Myers (1930). According to his note, various stages of "wing" development were found in this species in the acid waters of Mt. Desert Island, Maine, but the forms from Atlantic County, New Jersey, had no lateral wing-like processes. At that time, this species had been found in only four places in the world, i.e., near Moscow, Russia, Arc-en Barrois (Haute-Marne), France, and the two localities mentioned above. The present finding is probably the first record in the Far East.

***Euchlanis triquetra* Ehrenberg, 1838**

Pl. 2, Figs. 28, 28a

1838 *Euchlanis triquetra* Ehrenberg, Infusions-thierchen, p. 461.

Length, 220  $\mu$ ; width, 240  $\mu$ .

The dorsal plate is larger than the ventral plate, is triradiate in cross section, and has a median keel. The sides are roundly expanded; in lateral view the highest portion is at the center, gradually decreasing in height anteriorly and decreasing suddenly near the posterior end. The ventral plate is slightly concave, about two thirds as wide as the dorsal plate. This species was found in the littoral region of Tai-taik (1b).

***Testudinella bidentata* (Ternitz, 1892)**

Pl. 3, Figs. 34, 34a

1892 *Pterodina bidentata* Ternitz, Rotatorien der Umgebung Basels, p. 20.

This species is nearly circular in shape. The dorsal plate has a convex frontal edge with a small central notch. On each side of the hind portion a small triangular projection is present, the tips of which are 100 micra apart. In the ventral plate the frontal edge is concave, but it swells out slightly centrally. A polygonal foot-opening is situated at the posterior extremity. In cross section (Fig. 34a), the ventral side is flat, but the dorsal side forms a low arc. This species was found in the region off the shore of Tai-taik (1b). In Japan there is only a single record from the Koishikawa Botanic Garden of Tokyo (T. Kawamura).

***Ploesoma triacanthum* (Bergendal, 1892)**

Pl. 3, Fig. 36

1892 *Gastroschiza triacanthum* Bergendal, Univ. Lundensis, Acta 28: 1.

The anterior end of the head is separated into three triangular processes of which the central one is the longest. In general, this portion bends downward as a shield-like head. This species was found only in the littoral region of Tai-taik (1b).

***Keratella cruciformis* (Thompson, 1892)**var. ***eichwaldi*** Levander, 1894

Pl. 1, Fig. 14, 15

1892 *Anuraea cruciformis* Thompson, Liverpool Biol. Soc., Proc. 6: 77.



1894 *Anuraea eichwaldi* Levander, Soc. Fauna Flora Fennica, Acta 12: 62.

Total length, 120  $\mu$ .

This brackish-water species was found in every part of Lake Kandong-po (9a, b, c). The hind process is absent. Both the punctate and reticular sculptures are remarkable. In the dorsal lorica, the frontal plate is very short (c. 10  $\mu$ ), but the first carinal plate is remarkably long (c. 75  $\mu$ ).

*Keratella serrulata* (Ehrenberg, 1838)

Pl. 2, Fig. 20

1838 *Anuraea serrulata* Ehrenberg, Infusions-thierchen, p. 508.

Total length: 195  $\mu$  (from the frontal notch to the posterior end, 130  $\mu$ , length of the ventral plate, 120  $\mu$ ). Width: frontal end 98  $\mu$ , greatest, 112  $\mu$ , hind end, 54  $\mu$ ; frontal processes: central, 65  $\mu$ , sublateral, 22  $\mu$ , lateral, 25  $\mu$ .

Both the punctate and reticular sculptures are remarkable in the dorsal plate. The last central plate is hexagonal, and from its posterior corner a central line runs posteriorly. Both posterior corners project slightly. The central pair of the frontal processes are long and stout, bending downward remarkably near the tip. This is a characteristic species of dystrophic water. Skadowski (1923) has found this species in moorland waters, in which the pH values ranged from 3.2 to 4.5. The pH value of the present locality (1b) measured as high as 6.3.

#### DISTRIBUTIONAL RELATIONSHIPS

As already noted, in the western region only a collection of potamoplankton was made, on the river Taidong-gang (16), where only five rotatorian species were found. This number is not small for a collection from a river, but there are very few individuals of the species, four of which were found in three other regions. Therefore, the fauna of the western region should not be considered here.

The species common to the three other regions number eight, or less than 10 per cent.

In general, these species are well known to be widely distributed animals. They are all pelagic except *Diurella tigris*. The frequencies of occurrence are as follows:

<i>Polyarthra trigla</i>	12 stations
<i>Keratella cochlearis</i>	10 stations
<i>Keratella cochlearis</i> var. <i>tecta</i>	7 stations
<i>Asplanchna priodonta</i>	9 stations
<i>Filinia longiseta</i>	6 stations
<i>Synchaeta oblonga</i>	4 stations
<i>Trichocerca longiseta</i>	4 stations
<i>Diurella tigris</i>	3 stations

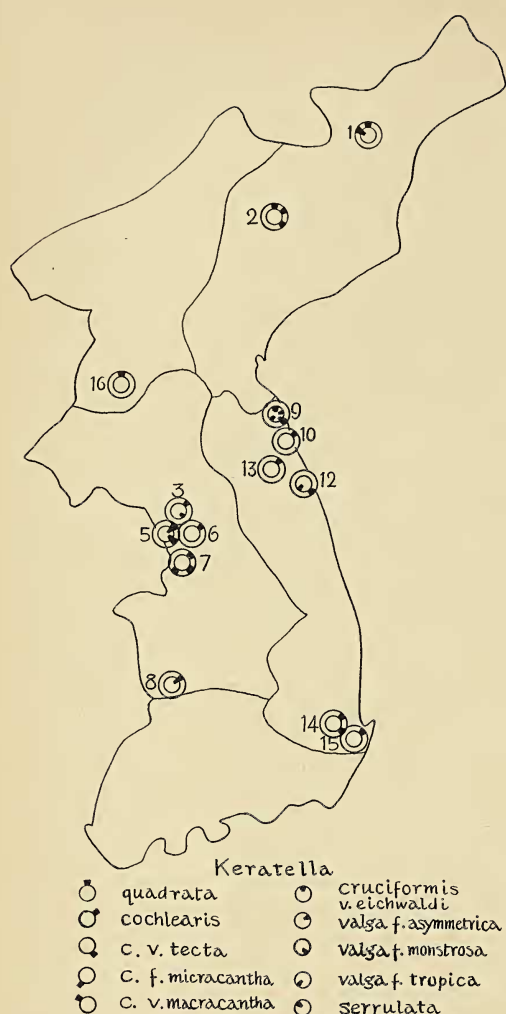
The number of species peculiar to any one region of northern, middle, or eastern Korea are 17, 25, and 19, respectively. The total peculiar to one region, 61, is three fourths of the total number. Of the 13 species remaining, 8 are found both in the middle and eastern regions, 3 others are found both in the northern and middle regions. One species (*Lepadella ovalis*) is found in both the northern and the eastern regions.

The collections in northern Korea were made chiefly in summer. Seventeen species obtained from this region are, without exception, found only from Tai-taik. Only one from Tai-taik, *Keratella quadrata*, is also found in the collection from Puchon-ho, and in the Taidong-gang of the western region. This suggests that the conditions of Tai-taik differ greatly from those of any other waters visited. The occurrence of *Keratella cochlearis* var. *macracantha* is worthy of note as this collection was made in midsummer and this has been considered heretofore to be a winter form.

In Tai-taik 23 species of Rotatoria were found, i.e., 8 from the pelagic, 18 from the littoral, and 3 among the mosses of the marginal region.

In a work on the plankton of Lake Puchon-ho, the present author (1941) has noted that at the early stage of the development of the reservoir many heleoplankters such as *Conochilus hippocrepis* were found, but after several years the condition of the water so changed that *Synchaeta* spp. and *Keratella quadrata* ap-



Fig. 2. Occurrences of the genus *Keratella* in Korea.

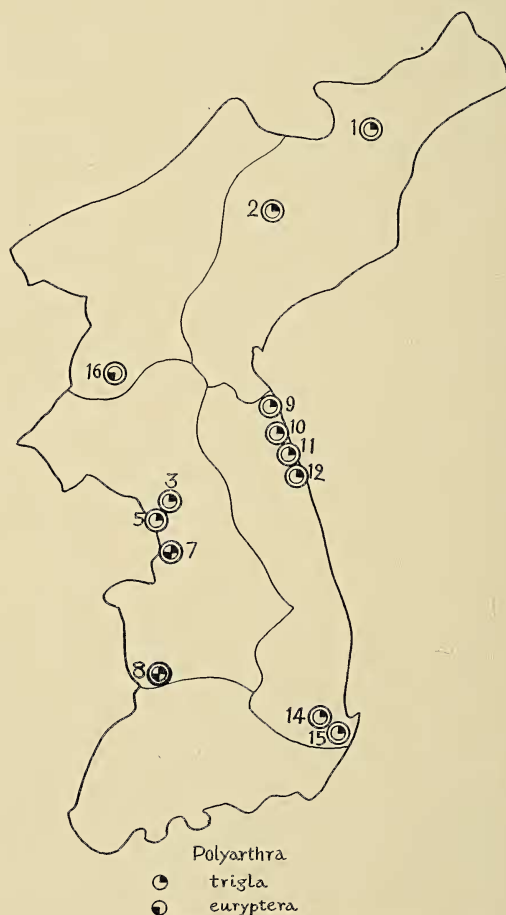
peared. In July, 1941, *Asplanchna priodonta* was the predominant species, being especially abundant in the epilimnion. The nine species reported from this reservoir, excepting *Keratella quadrata*, are common to the middle and eastern regions.

In the middle region, three of the samplings were made by Sato from localities in and around Seoul. Among them, one from a pool at Shindo-cho (4) contained only a single species, *Conochilus hippocrepis*. The collections from a pool at Shochudan (3) and from Ei-toho (5) contained 11 species each. A remarkable condition common to these two localities

is the richness of species belonging to the family Brachionidae, i.e., eight from the former and six from the latter. It is particularly noteworthy that species of a warm-water type are found here, e.g., *Brachionus forficula* in the latter and *Keratella valga* in both localities.

As potamoplankton of the Hang-gang (6), only a single species (*Keratella cochlearis*) was found, but Sato (1939) has reported two species, *Asplanchna priodonta* and *Testudinella patina*, from the same river in winter.

Besides our collection from Seiko (7), those taken by Kawamura on June 2, 1936 (7a), were examined. Notwithstanding the fact that the season of collection was quite different, 11 species found in early summer were all included among the 18 species collected in

Fig. 3. Occurrences of the genus *Polyarthra* in Korea.

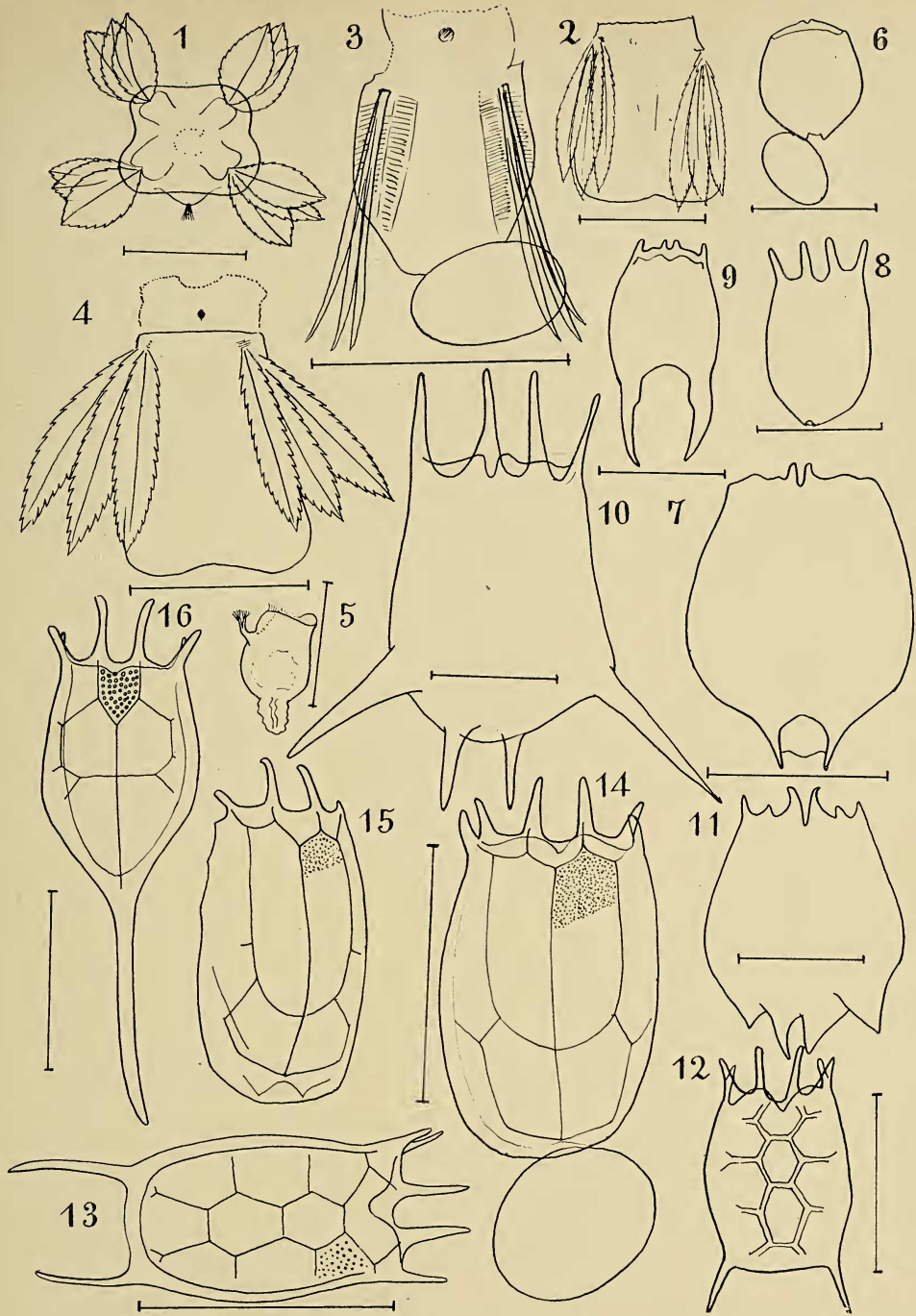


PLATE I  
(Line scales represent 100 micra except those marked otherwise)

- FIG. 1. *Polyarthra euryptera*

FIG. 2. *Polyarthra trigla*

FIG. 3. *Polyarthra trigla* var. *remata*

FIG. 4. *Polyarthra trigla* var. *major*

FIG. 5. *Conochiloides dossuarius*

FIG. 6. *Brachionus angularis*

FIG. 7. *Brachionus angularis* (type)

FIG. 8. *Brachionus budapestinensis*
- FIG. 9. *Brachionus forficula*

FIG. 10. *Brachionus calyciflorus*

FIG. 11. *Brachionus quadridentatus*

FIG. 12. *Keratella quadrata*

FIG. 13. *Keratella valga* f. *tropica*

FIG. 14. *Keratella cruciformis* var. *eichwaldi*

FIG. 15. *K. cruciformis* var. *eichwaldi* (from Sakhalin, after Yamaguchi)

FIG. 16. *Keratella cochlearis* var. *macracantha*

late autumn. In both cases *Asplanchna priodonta* and *Keratella cochlearis* were found abundantly. The length of the posterior process of the latter species varies greatly, showing stages almost continuous from *tecta*-type to *typica*-type (Fig. 2). *Polyarthra trigla* shows a very wide distribution (Fig. 3). In the specimens from Seiko, two varieties were included (var. *major* and var. *remata*).

Of 17 species reported by Hada (1936) from this lake, 7 were also obtained in the present survey. They belong chiefly to the pelagic species, while the remainder are those of the creeping type. The occurrence of such bottom-inhabiting forms may be attributed to vertical hauls. The total number of species recorded from this lake is 28. This is the greatest number of species found in any single locality in Korea.

Seventeen species were found in two collections from Kanggyong. One collection from a small pond (8a) contained 13 species. Of these, *Brachionus calyciflorus* shows great variability, many types such as *typica*, *amphiceros*, *anuraeiformis*, *dorcas*, and *spinosus* being identified. Another collection from a pond (8b) contained 10 species, of which 7 are also found in pond 8a. No remarkable morphological characteristics can be found.

In the eastern region, the greatest number of species was found from Kangdong-po (9a, b, c). The total here is 23, if Sato's (1941) record is added. The present collections were made from a small boat at three stations on the lake. *Notholca* occur in all three stations, *Notholca acuminata* in the first and third stations, and *Notholca labis* in the second. These species have been known as brackish-water forms and were also found in Lake Kam-ho (12).

Of eight species found in Kam-ho, six are also found in Kangdong-po.

The remaining two localities are located in the far southern region of eastern Korea, near the coast of the Japan Sea. An unnamed pond is situated to the west of the Bukkokuji railway station (14). Its area is considerable and

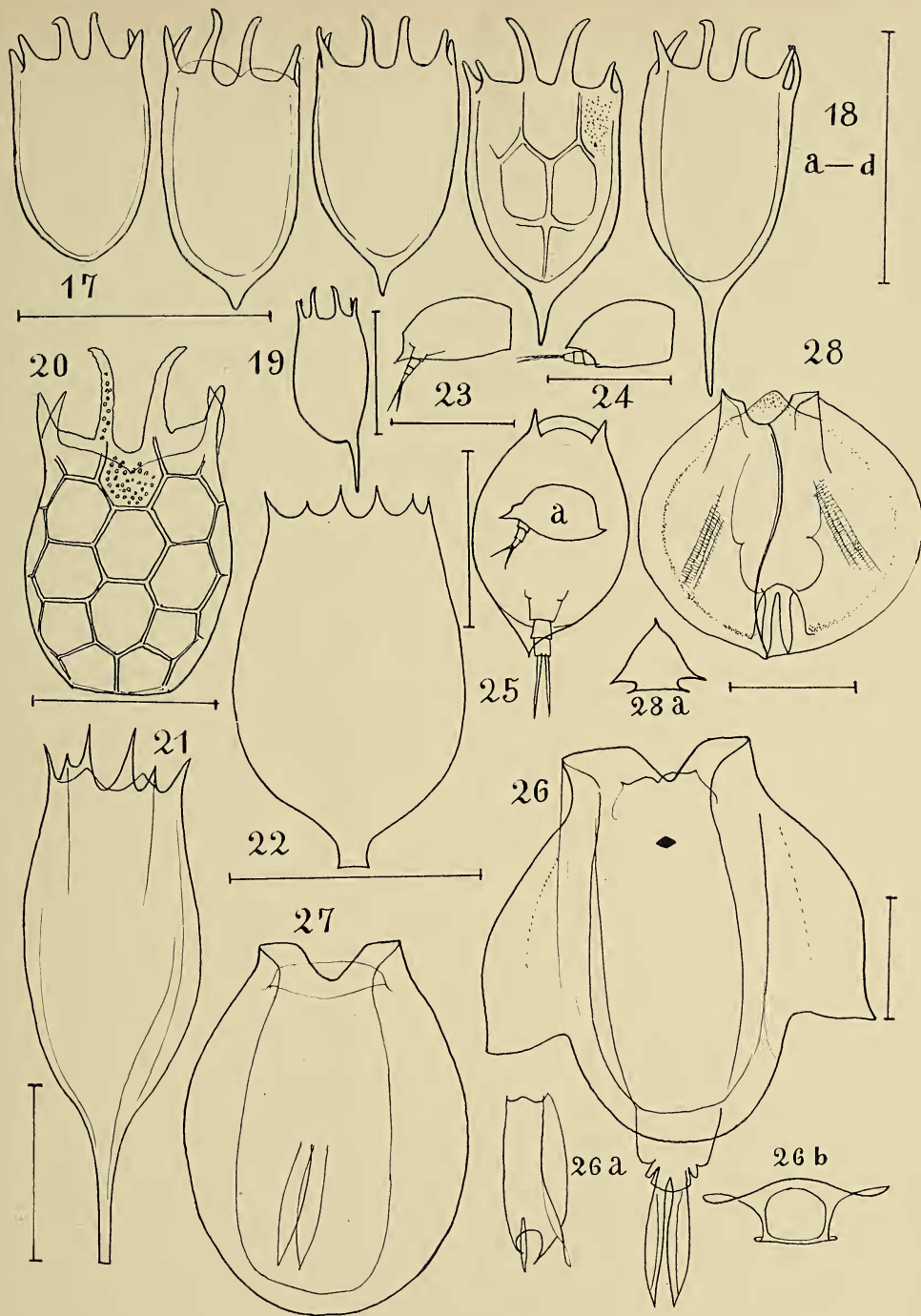
it receives several brooks from the rice fields around it. Eight species were found both in the collections from the surface and in those from the bottom, the total being 14. There are two common species in these two places, one pelagic and the other a creeping species—*Keratella cochlearis* and *Diurella tigris*.

Throughout all the regions surveyed, the species belonging to the genus *Keratella* occur most frequently. The features of its distribution seem to be characteristic. *Keratella cochlearis* in both forma *typica* and var. *tecta* is distributed in the northern, middle, and eastern regions, whereas the remaining forms seem to be limited to a single region. *K. quadrata*, *K. serrulata*, and *K. cochlearis* var. *macracantha* are distributed chiefly in the northern region, *K. cochlearis* f. *micracantha*, *K. valga* f. *asymmetrica*, and f. *monstrousa* in the middle, and *K. cruciformis* var. *eichwaldi* and *K. valga* f. *tropica* in the eastern region. *K. quadrata* was, however, found also in the western region, and its forma *asymmetrica* has been recorded by Sato (1941) as a summer plankton animal of Kangdong-po.

It is remarkable that the distribution of species of southern origin, such as *K. valga* f. *tropica*, have shown a late autumn occurrence in the district of the Japan Sea coast. This suggests that the influence of the northward-flowing warm current along the coast of North Korea upon the climate of this district may be one of the factors acting in the distribution of this species. It is also interesting that, in spite of the collections having been made in the northern region in summer and in the southern region in late autumn, *K. quadrata* appears to be distributed strictly in the northern part and *K. valga* only from the southern region (Fig. 2).

Species belonging to the genus *Brachionus* occurred in comparatively few places. Two of these localities were the stations in and about the city of Seoul where the collections were made by Sato. In the present survey, *Brachionus* species were found in only three localities, i.e., Kanggyong, the Kangdong-po, and





## PLATE II

(Line scales represent 100 micra except those marked otherwise)

FIG. 17. *Keratella cochlearis* var. *tecta*FIG. 18a-c. *Keratella cochlearis* f. *micracantha*FIG. 18d. *Keratella cochlearis* s. str.FIG. 19. *Keratella valga* f. *monstrosa*FIG. 20. *Keratella serrulata*FIG. 21. *Notholca acuminata*FIG. 22. *Notholca labis*FIG. 23. *Colurella leptæ*FIG. 24. *Colurella obtusa*FIG. 25. *Lepadella acuminata* (a: side view)FIG. 26. *Euchlanis alata* (a: side view; b: frontal view)FIG. 27. *Euchlanis alata* (wingless form)FIG. 28. *Euchlanis triquetra* (a: cross section)



Fig. 4. Occurrences of the genus *Brachionus* in Korea.

the Gan-o-chi. In Gan-o-chi, two species of *Brachionus* (*B. urceolaris* and *calyciflorus*) occurred, whereas in Kangdong-po only a single species (*B. quadridentatus* var. *brevispinus*) was found. At Kanggyong two species (*B. angularis* var. *bidens* and *B. calyciflorus*) occurred; five forms of *B. calyciflorus* were observed in the pond along the railroad (8a) as previously mentioned.

The values of the hydrogen ion concentration of water in these places indicate that, although the range tolerated by this genus would be rather wide, the organisms prefer alkaline waters. This seems also to correspond to conditions in Korean waters, though the

occurrences of this genus are limited to fewer localities. As is mentioned above, none of them was found in the northern region. As far as our collections are concerned, one species was found from the middle and two from the eastern region, a fourth was common to both. Besides these, two (*budapestinensis* and *forficula*) were found in the collections made by Sato. They are warm-water forms. Thus, a total of six species of *Brachionus* is known from the middle and eastern regions (Fig. 4).

#### SUMMARY

1. Plankton collections were made in Korea at 16 places, which may be classified roughly into four regions—the northern, western, middle, and eastern.

2. Fifty-eight species of Rotatoria were identified in these collections. In addition, seven species can be added from previous records. With the addition of eight varieties and seven forms, plus three undeterminable species, the total number becomes 83.

3. The species of wide distribution are *Keratella cochlearis* and *Polyarthra trigla*, both including several varieties or forms.

4. Species of *Brachionus* were found only in a few stations.

#### REFERENCES

- AHLSTROM, E. H. 1940. A revision of the rotatorian genera *Brachionus* and *Platylas* with descriptions of one new species and two new varieties. *Amer. Mus. Nat. Hist., Bul.* 77: 143–184.
- CARLIN, B. 1943. Die Planktonrotatorien des Motalaström. *Lund Univ., Limnol. Inst., Meddel.* 5: 1–255.
- COLLIN, A., H. DIEFFENBACH, R. SACHSE, and M. VOIGT. 1912. Rotatoria und Gastrotricha. In Brauer: *Die Süßwasserfauna Deutschlands*. Vol. 14. 274 pp. Gustav Fischer, Jena.
- EDMONDSON, W. T., and G. E. HUTCHINSON. 1934. Report on Rotatoria. Yale North India Expedition. *Conn. Acad., Mem.* 10: 153–186.

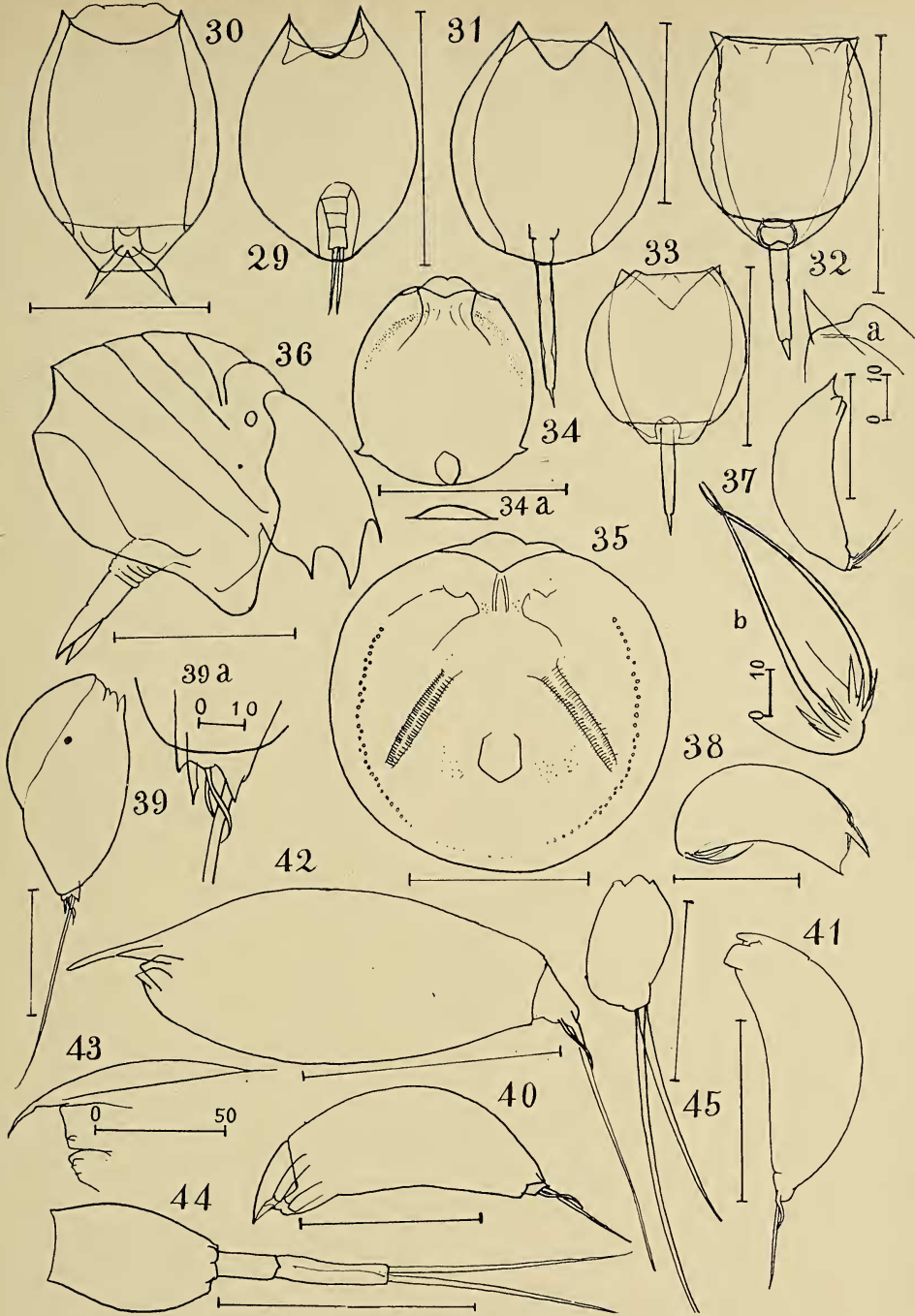


PLATE III

(Line scales represent 100 micra except those marked otherwise)

- FIG. 29. *Lepadella ovalis*  
FIG. 30. *Lecane brachydactyla*  
FIG. 31. *Monostyla lunaris*  
FIG. 32. *Monostyla furcata*  
FIG. 33. *Monostyla crenata*  
FIG. 34. *Testudinella bidentata* (a: cross section)  
FIG. 35. *Testudinella patina*  
FIG. 36. *Ploesoma triacanthum*  
FIG. 37. *Diurella tigris* (a: head; b: toes)
- FIG. 38. *Diurella porcellus*  
FIG. 39. *Trichocerca cristata*  
FIG. 40. *Trichocerca capucina*  
FIG. 41. *Trichocerca pusilla*  
FIG. 42. *Trichocerca longiseta*  
FIG. 43. *Trichocerca cylindrica* (head)  
FIG. 44. *Scardium endactylotum*  
FIG. 45. *Monommata grandis*



- HADA, Y. 1936. (The plankton of Lake Seiko, Suigen in autumn.) *Chosen Nat. Hist. Soc., Jour.* 21: 1-11. [In Japanese.]
- 1938. Rotatorian fauna of Manchoukou. *Sapporo Nat. Hist. Soc., Trans.* 15: 171-186.
- HARRING, H. K. 1913. Synopses of Rotatoria. *U. S. Natl. Mus., Bul.* 81: 1-226.
- HAUER, J. 1938. Die Rotatorien von Sumatra, Java und Bali nach den Ergebnissen der Deutschen Sunda-Expedition. *Arch. f. Hydrobiol., Suppl.* 15: 297-384, 507-602.
- HUDSON, C., and P. GOSSE. 1886-89. *The Rotifera or wheel-animalcules*. 312 pp. Longmans, Green & Co., London.
- KAWAMURA, T. 1917. *Freshwater biology of Japan*. 2 vols., 579 pp. Shokabo, Tokyo. [In Japanese.]
- MYERS, E. J. 1930. The rotifer fauna of Wisconsin. V. The genera *Euchlanis* and *Monommata*. *Wis. Acad. Sci., Arts, Letters, Trans.* 25: 353-413.
- RYLOV, W. M. 1935. Das Zooplankton der Binnengewässer. *Die Binnengewässer*. Vol. 15. 272 pp. Schweizerbart, Stuttgart.
- SATO, T. 1939. Potamoplankton of the River Hang-gang in early winter. *Jap. Jour. Limnol.* 10: 128-130. [In Japanese.]
- 1941. Biological notes on the brackish water lake Kodoko on the Japan Sea coast of Korea. *Jap. Jour. Limnol.* 11: 85-88. [In Japanese.]
- SCHÖNICHEN, W. 1917. *Einfachste Lebensformen des Tier und Pflanzenreiches*. Vol. 2. Urtiere, Rädertiere. 522 pp. Hugo Bermuehler, Berlin.
- UENO, M. 1941. Introductory account of the biological survey of inland waters of northern Chosen [Korea]. *Jap. Jour. Limnol.* 11: 96-107. [In Japanese.]
- YAMAMOTO, K. 1941. The plankton of lake Fusenko of northern Chosen [Korea]. *Jap. Jour. Limnol.* 11: 108-117. [In Japanese.]
- 1944. The Rotatoria from the fresh waters of the Yangtse delta. Reports on the limnological survey of central China. XVII. *Shanghai Sci. Inst., Jour.* 14: 90-117. [In Japanese.]
- YAMASAKI, M. 1940. Freshwater Rotatoria of Manchoukuo. *Report of the limnological survey of Kwantung and Manchoukuo*. T. Kawamura, ed. 573 pp. Government of Kwantung Prov., Dairen. [In Japanese.]